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The Safety of Orthokeratology—A Systematic Review

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Objectives: The aim of this review is to evaluate the ocular safety of orthokeratology (OrthoK) treatment of myopia correction and retardation.

Data Sources: Clinical studies published in English and Chinese were identified from MEDLINE, EMBASE CNKI, CQVIP, and WANFANG DATA (all from 1980 to April 2015). The reference lists of the studies and the Science Citation Index were also searched.

Selection Criteria: Relevant clinical studies including case series, case reports, patient/practitioner surveys, retrospective and prospective cohort studies, and clinical trials were all included in the review. The material of OrthoK lenses was limited to gas-permeable lens.

Main Results: This review incorporated a total of 170 publications, including 58 English and 112 Chinese literature. The risk of microbial keratitis in overnight OrthoK was similar to that of other overnight modality. The most common complication was corneal staining. Other clinically insignificant side effects included epithelial iron deposit, prominent fribrillary lines, and transient changes of corneal biomechanical properties. There was no long-term effect of OrthoK on corneal endothelium.

Conclusions: There is sufficient evidence to suggest that OrthoK is a safe option for myopia correction and retardation. Long-term success of OrthoK treatment requires a combination of proper lens fitting, rigorous compliance to lens care regimen, good adherence to routine follow-ups, and timely treatment of complications.

Key Words: Orthokeratology—Myopia correction—Myopia control—Safety—Complications—Side effects.

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INTRODUCTION

Orthokeratology (also known as OrthoK, OK, corneal reshaping, corneal refractive therapy, and vision shaping treatment) is an alternative method to correct refractive errors using custom-designed rigid lenses to temporarily modify the curvature of cornea.[1,2] Modern OrthoK technology uses breathable rigid lens material and reverse geometry designs to allow faster and more effective corneal reshaping.[3] Contrasting to the traditional OrthoK designs, which use a series of progressively flattening concentric curves surrounding a central base curve fitting in alignment with the central cornea, the modern reverse geometry designs for myopia correction are characterized by a central base curve, that is, fitted significantly flatter relative to the central corneal curvature and one or more surrounding steeper secondary or "reverse" curves that enable a smooth transitioning from the flat-fitting base curve to the alignment-fitting landing curve. The unique reverse geometry design significantly improves the overall centration of OrthoK lenses despite their flatter-fitting base curves, and more efficient distribution of the hydraulic pressure underneath the lenses, allowing fasters and more significant central corneal flattening.[1–3] Currently, the most common clinical application of OrthoK is for the reduction of myopia through corneal flattening.

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Myopia Epidemiology and Public Health Impact

Recent years have been marked by dramatic increases in the prevalence of myopia worldwide,[4] reaching near epidemic proportions in many urban Asian communities. In East Asia, nearly 50% of urban populations are myopic, and the prevalence figure for university student populations is approximately 90%.[5,6] In parallel with the rising prevalence figures, there has also been an increase in the average degree of myopia, with Chinese populations recording some of the largest increases. The rate of progression of myopia is fastest among young children with an approximate rate of 0.50 D per year across various ethnicity groups.[6,7]

Myopia is now a major public health problem, and high myopia is ranked second as the leading cause of visual impairment globally. Moreover, the onset of visual complications from myopia occurs much earlier than other causes of blindness and thus its impact on quality of life is also seen earlier.[8] The economic burden of myopia is also great, with expenditures on myopia-related optical corrections estimated more than $2 billion annually in the United States alone.[9] For those reasons alone, methods for preventing myopia and controlling its progression are urgently needed.

Myopia Control and OrthoK

Owing to the severity of ocular complications associated with high myopia, tremendous efforts have been put into the investigation of interventions that may retard the progression of myopia in children, thus decreasing the severity of myopia at maturity.[10–13] It has been consistently demonstrated in various animal models including primates that optical interventions have a strong impact on refractive error development.[12,14,15] OrthoK, among other novel contact lens designs being investigated, has been shown in multiple clinical studies as effective in slowing down myopic progression.[7,16–18] Combining its unique advantage of providing clear unaided vision during daytime, overnight

OrthoK has become one of the most popular choices among children for refractive correction. However with the rapid increase of the utilization of OrthoK worldwide, potential complications associated with this treatment, especially used as overnight modality, have become a significant concern.

OBJECTIVES

The objective of this study was to systematically compile the current evidence from relevant peer-reviewed publications both in English and Chinese to evaluate the safety of OrthoK for the temporary treatment of myopia. Because the visual side effects were related to the design of the lens, the baseline myopia, and practitioners' clinical expertise in fitting evaluation, this review only focuses on ocular side effects of the treatment rather than visual complications, such as undercorrection of myopia, daytime vision regression, induced astigmatism, and induced higher order aberration.

METHODS

Selecting Studies for This Review

Types of Studies

Data from all types of relevant clinical studies including case series, case reports, patient/practitioner surveys, retrospective and prospective cohort studies, and clinical trials were included in the review. Because the focus of the review was on the incidence of side effects related to OrthoK, there was no limitation on the primary objective of the studies, that is, whether the treatment was used for myopia correction or for myopia control. Similarly, publications on OrthoK lenses used as overnight or daytime wear modalities were both included in the review.

Search Methods for Identification of Studies

As a large proportion of previously published OrthoK-related complications were from East Asia, especially from China, the literature published both in English and Chinese were identified from the Cochrane Library, MEDLINE, EMBASE, CNKI, CQVIP, and WANFANG DATA using the following strategies.

(1) orthokeratolog* OR orthok* OR corneal reshaping OR reverse geometry lens
(2) myopia AND correct* OR control OR retardation OR therap* OR treatment*
(3) keratitis OR safety OR side effects OR adverse effects OR complications OR risk
(4) (1) AND (2) AND (3)

The publication type is restricted to *clinical studies* and the material of the OrthoK lens was limited to gas-permeable material only.

The titles and abstracts were assessed and full copies of all potentially or definitively relevant studies were obtained to determine whether the studies met the criteria for inclusion in this review. References of all included publications were also reviewed.

Validity Assessment

Owing to the retrospective nature of the studies reporting treatment-related side effects, most reviewed studies were subject to some level of biases such as selection bias, performance bias, attrition bias, and/or detection bias. As a result, none of the relevant publications were excluded from the review based on the risks of bias.

DESCRIPTION OF STUDIES

The original electronic searches identified 378 abstracts, of which 133 were in English language and 245 were in Chinese. For further assessment, 269 potentially relevant publications were retrieved, and 99 were subsequently excluded, leaving a total of 58 English and 112 Chinese literature in the final review.[17,19–49,50–80,81–110,111–140,141–165,166–189]

RESULTS

Microbial Keratitis

Microbial keratitis (MK) remains as the most serious and sight-threatening complication of OrthoK. Van Meter et al.[66] provided a comprehensive review of the MK cases published in English since 1998, with most cases reported in Taiwan, Hong Kong, and Mainland China and presented as sporadic pattern without significant association with the baseline level of myopia, gender, or the specific brand of the OrthoK lenses. The sporadic pattern of MK was similarly reported in earlier Chinese publications and the attributable factors of the cases included lack of training of practitioners and wearers, improper fitting procedures, poor compliance to lens care regimens, and lost to routine follow-ups.[38,41,49,58,189] A more recent large-scale multicentered retrospective study reported the estimated incidence rate of MK as 7.7 cases per 10,000 patient years (95% CI, 0.9∼27.8), and risk of MK with overnight OrthoK was similar to other overnight modalities.[74] Since the publication of the aforementioned two major reviews, there had been few sporadic cases of MK reported, mostly in a tertiary eye care hospital in Hong Kong.[76]

Corneal Staining, Lens Binding, and Tear Film Stability

Corneal staining was commonly reported in patients wearing OrthoK lenses.[37,55,61,65,96,103,107,130,149,164,185,187] Commonly reported grading systems included Efron scale, Cornea and Contact Lens Research Unit scale, and Oxford scheme. Although mild corneal staining was also a common ocular finding in non–contact lens wearers, OrthoK has been reported to increase both the frequency and the severity of staining. Higher baseline myopia was reported to be positively associated with the level of staining[103,107,130,149,164,185,187]; however, age did not seem to be a significant factor in observed corneal staining after OrthoK treatment. Lens binding was another most commonly seen complication in overnight OrthoK and was significantly associated with central corneal staining.[130,149,185,187] Chronic wear of OrthoK lenses was also significantly associated with reduced basal tear secretion[187] and tear film stability, however with limited information reported dry eye symptoms.[185,187,190]

Epithelial Iron Deposit/White Lesion/Fibrillary Lines

Pigmented iron ring or arcs and adjacent white linear lesions had often been reported as a result of chronic wear of OrthoK lenses, and the incidences of the lesions were significantly associated with the duration of OrthoK treatment.[24,31,34,40,45,54,59] The findings were reported to be in subepithelial layer and usually were clinically insignificant. Prominent fibrillary white lines were also reported in long-term OrthoK treatment and were thought to represent nerve fibers in the subbasilar plexus.[59]

Endothelium

None of the studies investigating the short-term or long-term impact of OrthoK lenses on corneal endothelium reported evidence of OrthoK lenses worn overnight or during daytime had significant impact on the density or the morphologic features of corneal endothelial cells.[96,101,110,111,115,141,190]

Corneal Thickness

Significant central corneal thinning up to 20 microns associated with mid-peripheral thickening up to 25 microns has been commonly reported. The onset of significant central thinning was reported as quickly as 24 hour after initiation of lens wear and usually peaked at 1 week after overnight treatment.[1–3,109,110] The central thinning was predominantly in epithelial layer; however, the mid-peripheral thickening involved both epithelial and stromal components.[27,35,36,44,48,93,96,110,115,127,141,190]

Intraocular Pressure/Corneal Hysteresis/Corneal Resistance Factor

Corneal compensated intraocular pressure (IOP) and Goldmann-correlated IOP decreased and reached trough level around 1 week of OrthoK treatment.[124,173,184,191] Significant decreases in corneal hysteresis (CH) and corneal resistance factor (CRF) were also reported within the first week after the treatment; however, both IOP and CH gradually returned to baseline level at 1 month of lens wear.[124,191]

DISCUSSION

OrthoK, either worn overnight or during daytime, is considered a viable option for temporary myopia correction and myopia control. With the drastic increase in the prevalence of myopia worldwide and the overall earlier onset of myopia, the popularity of OrthoK also increases significantly accordingly. Potential complications significantly associated with OrthoK include MK, corneal staining, and lens binding. There are other clinically insignificant side effects such as epithelial pigment deposit and increasing visibility of fibrillary lines, and transient changes of corneal biomechanical properties.

Microbial Keratitis

Owing to potentially serious consequence, infectious keratitis remains the most concerning complication related to OrthoK. At least three factors have been shown to increase the risks of MK of overnight OrthoK. Extended/overnight lens wear remains the most significant risk factor for infection.[19,20,67] It is likely that overnight modality allows more time "for bacteria to colonize the contact lens and adapt to the environment to become appropriately virulent."[70] Additionally, it is also suggested that overnight lens wear may reduce ocular surface's defense against infection as it could compromise tear mixing between the pre– and post–lens tear compartments during blinking.[191] Furthermore, the reverse geometry design was hypothesized to further reduce the epithelial surface integrity likely because of its compressive hydraulic effect exerted on the cornea, hence increasing its susceptibility to infection.[49]

A large proportion of earlier reported complications, especially the more visually threatening cases such as MK, were originated from East Asia such as Mainland China and Taiwan. This was at least partially related to bigger population undergoing the OrthoK treatment, resulting in higher number of total incident cases. More importantly, in Mainland China, the overall incidence of MK decreased significantly after 2002, when China Food and Drug Administration posted regulations regarding the rigorous inspection and registration of OrthoK lenses, the training and certification of OrthoK practitioners, and the minimal requirements of instrumentation and fitting/follow-up procedures.[192] With the combined efforts from government agencies, administration of hospitals/clinics, industry partners, practitioners, and individual patients/parents, the use of OrthoK in Mainland China both for myopia correction and myopia control has entered a fast growing stage with improved standardized protocols, close monitoring system for the long-term efficacy and safety of the treatment, and better awareness and compliance of lens wearers.[79,128]

Although it has been reported that the incidence of MK tends to be slightly higher in children than in adults,[74] the data need to be interpreted with caution. First of all, the total number of incident cases was small, resulting in a bigger variance of the outcome estimate. Furthermore, most studies were subject to significant patient selection and participation bias because of the age difference of the patients. Although the exact magnitude of effect due to bias was difficult to evaluate because of the retrospective nature of most studies, the direction of the overall effect estimate will be biased toward younger aged patients, assuming better parental attention and a higher probability of seeking follow-up visits comparing to that of young adults.

In summary, considering the vision-threatening potential of MK and the direct association between the age and the expected OrthoK-wearing duration of the patients, practitioners should use great caution in fitting children with OrthoK lenses and it is important to provide extensive education to both patients and parents on rigorous compliance to lens caring regimen. It is also worth noting that *Pseudomonas aeruginosa* and *Acanthamoeba* were the most commonly reported pathogens for OrthoK-associated infectious keratitis, both of which require early diagnosis and prompt treatment to minimizing the risks of permanent vision loss. As a result, both patients and parents should remain high vigilance of possible related signs and symptoms; and to seek routine and timely follow-ups to minimize the risk of irreversible vision loss due to the complication.

Corneal Staining/Lens Binding

It is noteworthy that corneal staining could present in several distinctive patterns: sporadic or diffuse punctate staining; patchy central staining, especially the whorl shaped staining; and peripheral indentation rings. In authors' own experience, peripheral punctate staining was more commonly associated with preexisting conditions such as misdirected lashes, lid margin disorders, lagophthalmos, and sensitivity to contact lens solution and care products. However, persistent central staining was more associated with suboptimal OrthoK fitting and lens adherence to the corneal surface. Recurrent lens binding and superficial corneal abrasion on lens removal is one of the most common reasons for urgent care visits in OrthoK treatments. Several factors have been proposed to promote lens binding in overnight OrthoK, such as coated lens, decreased thickness and increased viscosity of post–lens tear film with overnight wear, eyelid pressure on OrthoK lens toward cornea, and the negative hydraulic pressure in post–lens tear film associated with reverse geometry lens designs pulling the lens closer to the central corneal surface.[37,61,107] Recurrent lens binding can often be resolved by improving the fitting and promoting tear exchange through lens adjustment. Although mild-to-moderate corneal staining does not always require cessation of daytime GP lens wear, it is strongly indicated to discontinue overnight OrthoK treatment temporarily if persistent central corneal staining worse than grade 2 (Efron scale) is observed, to avoid more serious complications such as deep corneal abrasion and/or corneal ulcer.

Epithelial Iron Deposit/White Lesion/ Fibrillary Lines

Pigmented ring shaped corneal deposition is a common finding in chronic OrthoK treatment and there seemed to be no evidence suggesting an ethnicity predisposition to this finding. Although the exact etiology of the sign is unclear, it has been hypothesized that the pigmented ring might be related to the stress forces applied to epithelium and/or tear stagnation underneath the reverse geometry zone.[24,31,45,54,73] All reported cases of pigmented corneal rings and adjacent white lesions were not near visual axis and were not visually significant and there was no treatment necessary. However considering the chronic nature of OrthoK treatment, careful photograph documentation and routine evaluation of both the density and the extent of the findings are recommended.

Endothelium

OrthoK, owing to its predominantly overnight wearing modality and the long-term nature of the treatment, and also its common utilization among pediatric patients, has raised concerns of its possible short-term and long-term impact on corneal endothelium. As a result, baseline and annual evaluation of endothelial integrity by specular microscopy has been commonly incorporated as part of the standard routine in OrthoK treatment in Mainland China. Evidence from large sample, longitudinal studies showed no significant short-term or long-term changes of endothelial cell density, corneal polymegethism, or polymorphism, reassuring the long-term safety of overnight OrthoK on endothelium.

Corneal Thickness

Significant central corneal thinning accompanied by mid-peripheral thickening has been consistently reported with fairly quick onset and usually stabilized after several weeks of OrthoK lens wear. There had been elevated concerns of secondary corneal ectasia because of OrthoK induced central corneal thinning; however, due to the small magnitude ($<$20 microns) of central corneal thinning and its predominant epithelial origin, the risk of OrthoK induced ectasia is minimal.[2,3,96,101] Mid-peripheral corneal thickening and steepening has been postulated as the main "myopia-controlling" stimulus, as it imposes significant myopic shift on peripheral retinal defocus, which has been considered as a potent myopia-inhibiting signal.[7–15] The overall magnitude of mid-peripheral corneal thickening and steepening has been reported to correlate with the level of baseline (pretreated) myopia hence corresponding central thinning and flattening induced by the treatment; however, more recent reverse geometry designs have been attempted on inducing more significant mid-peripheral steepening, that is, independent of central thinning and flattening (Personal communication with proprietary lens designers, Patrick Caroline, 2014).

Corneal Biomechanics

CH and CRF are corneal biomechanical properties measured by Reichert Ocular Response Analyzer (http://www.ocularresponseanalyzer.com). CH reflects the capacity of corneal tissue to recover back to its original shape after a transient application of external force. Compared with central corneal thickness, CH provides a more complete characterization of the contribution of corneal resistance to IOP measurements. CRF, a derivative from CH, indicates the overall resistance of corneal tissue that is relatively independent of IOP.[193] Significant decreases in IOP, CH, and CRF were reported within the first week after OrthoK treatment; however both IOP and CH gradually returned to baseline level at 1 month of lens wear and remained unchanged after 6 months.[124,190] Despite the early temporary reduction of CH, there was no evidence suggesting chronic OrthoK treatment altered corneal microstructure and its biomechanical properties.

Strength and Limitations and of This Review

This was the first review on the safety of OrthoK that used a systematic and objective approach to identify as many relevant literature as possible in both English and Chinese, hopefully to provide a comprehensive and balanced presentation of the topic.

This review faces several limitations. First of all, despite the large number of studies identified and included in the review, the absolute incidences of OrthoK-associated side effects were difficult to evaluate because of significant potential sampling bias, publication bias, and lost to follow-ups. Additionally, the wide variety of study designs made it difficult to perform meta-analysis so only the results from individual relevant studies were reported. Finally, owing to the time constraints, no further effort was made to contact the investigators of each study to clarify unclear data presentations in the original publications or to acquire necessary raw data to improve the efficiency of the data usage in the analysis.

CONCLUSIONS

OrthoK in general is a safe option for myopia correction and retardation. However, the long-term success of the treatment depends on a combination of multiple factors including proper fitting of the lenses, rigorous compliance to lens use and care regimen, adherence to routine follow-ups, and timely and appropriate treatments to complications.

FUTURE DIRECTION

To better estimate the absolute prevalence and incidence of OrthoK-related complications, future clinical practice and research should aim at establishing complete and systematic patient database and minimizing the rate of lost to follow-ups in the cases of long-term treatment. It is only with an accurate denominator, that is, the correct estimate of the patient-time in whichever cohort the incident cases were generated can a true incidence rate be accurately calculated. Additionally, more focused research on the independent effect of each factor, such as patient's baseline refractive error, corneal physiological and biomechanical profile, lens design, lens material, and treatment modality, etc., will provide valuable insights into guiding clinical decision making in maximizing the efficacy and safety of OrthoK treatment at individual patient level. Finally, continuous laboratory research on the pathogenesis of OrthoK-related MK, identifying subjective and objective indicators that focus on prediction and prevention of complications, and better understanding of long-term effects of OrthoK treatment are warranted, especially considering the early onset and the chronic nature of the treatment in most patients.

REFERENCES

1. Caroline PJ. Contemporary orthokeratology. *Cont Lens Anterior Eye* 2001; 24:41–46.
2. Dave T, Ruston D. Current trends in modern orthokeratology. *Ophthalmic Physiol Opt* 1998;18:224–233.
3. Swarbrick HA. Orthokeratology (corneal refractive therapy): What is it and how does it work? *Eye Contact Lens* 2004;30:181–185; discussion 205-6.
4. Kempen JH, Mitchell P, Lee KE, et al. The prevalence of refractive errors among adults in the United States, Western Europe, and Australia. *Arch Ophthalmol* 2004;122:495–505.
5. Morgan I, Rose K. How genetic is school myopia? *Prog Retin Eye Res* 2005;24:1–38.
6. Saw SM, Tong L, Chua WH, et al. Incidence and progression of myopia in Singaporean school children. *Invest Ophthalmol Vis Sci* 2005; 46:51–57.
7. Zhu MJ, Feng HY, He XG, et al. The control effect of orthokeratology on axial length elongation in Chinese children with myopia. *BMC Ophthalmol* 2014;14:141.
8. Saw SM, Gazzard G, Shih-Yen EC, et al. Myopia and associated pathological complications. *Ophthalmic Physiol Opt* 2005;25:381–391.
9. Vitale S, Cotch MF, Sperduto R, et al. Costs of refractive correction of distance vision impairment in the United States, 1999-2002. *Ophthalmology* 2006;113:2163–2170.
10. Aller TA, Laure A, Wildsoet C. Results of a one-year prospective clinical trial (CONTROL) of the use of bifocal soft contact lenses to control myopia progression. *Ophthalmic Physiol Opt* 2006;26:8–9.
11. Chua WH. Controlling progression of Childhood myopia - trials and Tribulations. *Am J Ophthalmol* 2005;139.
12. Charman WN. Aberrations and myopia. *Ophthalmic Physiol Opt* 2005;25: 285–301.
13. Stone RF, Flitcroft DI. Ocular shape and myopia. *Ann Acad Med Singapore* 2004;33:1.
14. Flitcroft DI. The complex interactions of retinal, optical and environmental factors in myopia aetiology. *Prog Retin Eye Res* 2012;31:622–660.
15. Smith EL. Prentice Award Lecture 2010: A case for peripheral optical treatment strategies for myopia. *Optom Vis Sci* 2011;88:1029–1044.
16. Swarbrick HA, Alharbi A, Watt K, et al. Myopia control during orthokeratology lens wear in children using a novel study design. *Ophthalmology* 2015;122:620–630.
17. Sun Y, Xu F, Zhang T, et al. Orthokeratology to control myopia progression: A meta-analysis. *PLoS One* 2015;10:e0124535.
18. Si JK, Tang K, Bi HS, et al. Orthokeratology for myopia control: A meta-analysis. *Optom Vis Sci* 2015;92:252–257.
19. Schein OD, Glynn RJ, Poggio EC, et al. The relative risk of ulcerative keratitis among users of daily-wear and extended-wear soft contact lenses. A case-control study. Microbial Keratitis Study Group. *N Engl J Med* 1989;321:773–778.
20. Cheng KH, Leung SL, Hoekman HW, et al. Incidence of contact-lens-associated microbial keratitis and its related morbidity. *Lancet* 1999;354: 181–185.
21. Chen KH, Kuang TM, Hsu WM. Serratia Marcescens corneal ulcer as a complication of orthokeratology. *Am J Ophthalmol* 2001;132:257–258.
22. Lu L, Zou L, Wang R. Orthokeratology induced infective corneal ulcer [in Chinese]. *Zhonghua Yan Ke Za Zhi* 2001;37:443–446.
23. Walline JJ, Mutti DO, Jones LA, et al. The contact lens and myopia progression (CLAMP) study: Design and baseline data. *Optom Vis Sci* 2001; 78:223–233.
24. Cho P, Chui WS, Mountford J, et al. Corneal iron ring associated with orthokeratology lens wear. *Optom Vis Sci* 2002;79:565–568.
25. Hutchinson K, Apel A. Infectious keratitis in orthokeratology. *Clin Exp Ophthalmol* 2002;30:49–51.
26. Rah MJ, Jackson JM, Jones LA, et al. Overnight orthokeratology: Preliminary results of the Lenses and Overnight Orthokeratology (LOOK) study. *Optom Vis Sci* 2002;79:598–605.
27. Alharbi A, Swarbrick HA. The effects of overnight orthokeratology lens wear on corneal thickness. *Invest Ophthalmol Vis Sci* 2003;44: 2518–2523.
28. Barr JT, Rah MJ, Jackson JM, et al. Orthokeratology and corneal refractive therapy: A review and recent findings. *Eye Contact Lens* 2003;29(1 Suppl):S49–S53; discussion S57-9, S192–4.
29. Cho P, Cheung SW, Edwards MH. Practice of orthokeratology by a group of contact lens practitioners in Hong Kong. Part 2: Orthokeratology lenses. *Clin Exp Optom* 2003;86:42–46.
30. Cho P, Cheung SW, Edwards MH, et al. An assessment of consecutively presenting orthokeratology patients in a Hong Kong based private practice. *Clin Exp Optom* 2003;86:331–338.
31. Cho P, Chui WS, Cheung SW. Reversibility of corneal pigmented arc associated with orthokeratology. *Optom Vis Sci* 2003;80:791–795.
32. Chui W, Cho P. Recurrent lens binding and central island formations in a fast-responding orthokeratology lens wearer. *Optom Vis Sci* 2003;80: 490–494.
33. Lau LI, Wu CC, Lee SM, et al. Pseudomonas corneal ulcer related to overnight orthokeratology. *Cornea* 2003;22:262–264.
34. Liang JB, Chou PI, Wu R, et al. Corneal iron ring associated with orthokeratology. *J Cataract Refract Surg* 2003;29:624–626.
35. Sridharan R, Swarbrick H. Corneal response to short-term orthokeratology lens wear. *Optom Vis Sci* 2003;80:200–206.
36. Wang J, Fonn D, Simpson TL. Topographical thickness of the epithelium and total cornea after hydrogel and PMMA contact lens wear with eye closure. *Invest Ophthalmol Vis Sci* 2003;44:1070–1074.
37. Wang JC, Lim L. Unusual morphology in orthokeratology contact lens-related cornea ulcer. *Eye Contact Lens* 2003;29:190–192.
38. Xuguang S, Lin C, Yan Z, et al. Acanthamoeba keratitis as a complication of orthokeratology. *Am J Ophthalmol* 2003;136:1159–1161.
39. Young AL, Leung AT, Cheung EY, et al. Orthokeratology lens-related Pseudomonas aeruginosa infectious keratitis. *Cornea* 2003;22:265–266.
40. Hiraoka T, Furuya A, Matsumoto Y, et al. Corneal iron ring formation associated with overnight orthokeratology. *Cornea* 2004;23(8 Suppl): S78–S81.
41. Hsiao CH, Yeh LK, Chao AN, et al. Pseudomonas aeruginosa corneal ulcer related to overnight orthokeratology. *Chang Gung Med J* 2004;27: 182–187.
42. Lang J, Rah MJ. Adverse corneal events associated with corneal reshaping: A case series. *Eye Contact Lens* 2004;30:231–233; discussion 242-3.
43. Young AL, Leung AT, Cheng LL, et al. Orthokeratology lens-related corneal ulcers in children: A case series. *Ophthalmology* 2004;111: 590–595.
44. Alharbi A, La Hood D, Swarbrick HA. Overnight orthokeratology lens wear can inhibit the central stromal edema response. *Invest Ophthalmol Vis Sci* 2005;46:2334–2340.
45. Cheung SW, Cho P, Cheung A. White lesion in the corneal pigmented ring associated with orthokeratology. *Ophthalmic Physiol Opt* 2005; 25:264–268.
46. Cho P, White P, Cheung SW. Orthokeratology lens–related ulcers in children: Author reply. *Ophthalmology* 2005;112:167–168; author reply 168–9.
47. DeWoolfson BH. Orthokeratology lens–related ulcers in children. *Ophthalmology* 2005;112:167; author reply 167.
48. Gardner HP, Fink BA, Mitchell LG, et al. The effects of high-Dk rigid contact lens center thickness, material permeability, and blinking on the oxygen uptake of the human cornea. *Optom Vis Sci* 2005;82:459–466.
49. Hsiao CH, Lin HC, Chen YF, et al. Infectious keratitis related to overnight orthokeratology. *Cornea* 2005;24:783–788.
50. Kwok LS, Pierscionek BK, Bullimore M, et al. Orthokeratology for myopic children: Wolf in sheep's clothing? *Clin Exp Ophthalmol* 2005;33:343–347.
51. Tseng CH, Fong CF, Chen WL, et al. Overnight orthokeratology-associated microbial keratitis. *Cornea* 2005;24:778–782.
52. Watt K, Swarbrick HA. Microbial keratitis in overnight orthokeratology: Review of the first 50 cases. *Eye Contact Lens* 2005;31:201–208.
53. Wilhelmus KR. Acanthamoeba keratitis during orthokeratology. *Cornea* 2005;24:864–866.

54. Cheung SW, Cho P, Bron AJ, et al. Case report: The occurrence of fibrillary lines in overnight orthokeratology. *Ophthalmic Physiol Opt* 2006;26:525–531.
55. Ng LH. Central corneal epitheliopathy in a long-term, overnight orthokeratology lens wearer: A case report. *Optom Vis Sci* 2006;83:709–714.
56. Priel A, Grinbaum A, Barequet IS. Severe Pseudomonas aeruginosa keratitis shortly after initiation of corneal refractive therapy. *Eye Contact Lens* 2006;32:1–2.
57. Ying-Cheng L, Chao-Kung L, Ko-Hua C, et al. Daytime orthokeratology associated with infectious keratitis by multiple gram-negative bacilli: Burkholderia cepacia, Pseudomonas putida, and Pseudomonas aeruginosa. *Eye Contact Lens* 2006;32:19–20.
58. Hsiao CH, Yeung L, Ma DH, et al. Pediatric microbial keratitis in Taiwanese children: A review of hospital cases. *Arch Ophthalmol* 2007;125:603–609.
59. Lum E, Swarbrick H. Fibrillary lines in overnight orthokeratology. *Clin Exp Optom* 2007;90:299–302.
60. Mika R, Morgan B, Cron M, et al. Safety and efficacy of overnight orthokeratology in myopic children. *Optometry* 2007;78:225–231.
61. Stillitano I, Maidana E, Lui M, et al. Bubble and corneal dimple formation after the first overnight wear of an orthokeratology lens: A case series. *Eye Contact Lens* 2007;33:253–258.
62. Watt KG, Boneham GC, Swarbrick HA. Microbial keratitis in orthokeratology: The Australian experience. *Clin Exp Optom* 2007;90:182–187; quiz 188-9.
63. Cho P, Cheung SW, Mountford J, et al. Good clinical practice in orthokeratology. *Cont Lens Anterior Eye* 2008;31:17–28.
64. Lipson MJ. Long-term clinical outcomes for overnight corneal reshaping in children and adults. *Eye Contact Lens* 2008;34:94–99.
65. Ng LH. Corneal foreign body injury during overnight orthokeratology lens wear: A case report. *Cont Lens Anterior Eye* 2008;31:158–160.
66. Van Meter WS, Musch DC, Jacobs DS, et al. Safety of overnight orthokeratology for myopia: A report by the American Academy of Ophthalmology. *Ophthalmology* 2008;115:2301–2313 e1.
67. Edwards K, Keay L, Naduvilath T, et al. Characteristics of and risk factors for contact lens-related microbial keratitis in a tertiary referral hospital. *Eye (Lond)* 2009;23:153–160.
68. Hiraoka T, Kaji Y, Okamoto F, et al. Corneal sensation after overnight orthokeratology. *Cornea* 2009;28:891–895.
69. Savitsky DZ, Fan VC, Yildiz EH, et al. Fluorophotometry to evaluate the corneal epithelium in eyes undergoing contact lens corneal reshaping to correct myopia. *J Refract Surg* 2009;25:366–370.
70. Fleiszig SM, Evans DJ. Pathogenesis of contact lens-associated microbial keratitis. *Optom Vis Sci* 2010;87:225–232.
71. Walline JJ, Lindsley K, Vedula SS, et al. Interventions to slow progression of myopia in children. *Cochrane Database Syst Rev* 2011:CD004916.
72. Cho P, Cheung SW. Retardation of myopia in Orthokeratology (ROMIO) study: A 2-year randomized clinical trial. *Invest Ophthalmol Vis Sci* 2012;53:7077–7085.
73. Gonzalez-Meijome JM, González-Pérez J, Garcia-Porta N, et al. Pigmented corneal ring associated with orthokeratology in Caucasians: Case reports. *Clin Exp Optom* 2012;95:548–552.
74. Bullimore MA, Sinnott LT, Jones-Jordan LA. The risk of microbial keratitis with overnight corneal reshaping lenses. *Optom Vis Sci* 2013;90:937–944.
75. Chen C, Cheung SW, Cho P. Myopia control using toric orthokeratology (TO-SEE study). *Invest Ophthalmol Vis Sci* 2013;54:6510–6517.
76. Chan TC, Li EY, Wong VW, et al. Orthokeratology-associated infectious keratitis in a tertiary care eye hospital in Hong Kong. *Am J Ophthalmol* 2014;158:1130–1135.e2.
77. Xu P. The clinical observation of orthokeratoloty treatment. *Chin Pract Ophthalmol* 2000;165:648–650.
78. Baiji, He XG, Wang WG, et al. Clinical research of orthokeratology for myopia correction. *New Dev Ophthalmol* 2000;166:288–289.
79. Chu RY, Qu XM, Li M. Orthokeratology: The current status in China and countermeasue. *New Dev Ophthalmol China* 2001;138:1–2.
80. Yeruizhen, Lixuexi, Xujiafeng. 165 cases of orthokeratology induced complications in adolescent wearers. *People's Military Medicine* 2002:230–231.
81. Yang GF, Zhou LX. Clinical observation of myopia correction with orthokeratology. *Clin Med* 2002;167:40–41.
82. Wang JQ, Hao YS, Feng HY. Comparison of digitalized and conventional orthokeratology. Presented at: Ophthalmology in China Academy Conference of Zhejiang Province. 2005;Lishui, Zhejiang.
83. Zheng XW, Huang RZ, Chen PS. Long-term observation of the effectiveness of orthokeratology in myopia correction in school myopia. *Huanan Prev Med* 2005;174:53–54.
84. Gu M, Qi YJ, Li BH, et al. Clinical observation of orthokeratology in myopia retardation. *Pract Diagnosis Ther* 2005:22–23.
85. Ji HY, Chi H, Yang LN, et al. Retrospective analysis of the safety and compliance of orthokeratology lens wear. Presented at: The 3rd Conference of Global Chinese Opthalmology Society, 2006. Beijing, China.
86. Zhang J, Deng P. *Safety of Orthokeraology*. Presented at: the 3rd Conference of Global Chinese Opthalmology Society, 2006. Beijing, China.
87. Hu ZL. 490 cases of orthokeratology lens fitting using trial lens method. *Chin Tech Refract Corr* 2006;170:101–103.
88. Xie PY. Nonsurgical correction and control of juvenile myopia and astigmatism. *Ophthalmol China* 2006;171:294–298.
89. Xie PY. The evaluation of the efficacy and safety of orthokeratology in myopia correction. Presented at: The 9th National Congress of Ocular Surface and Corneal Disease. 2006; Hangzhou, China.
90. Zhu J, Chen L. Four year longitudinal observation of orthokeratology in myopia correction. Presented at: The 12th National Congress of Ophthalmology in China. 2007; Zhengzhou, China.
91. Li B, Guo YH. Orthokeratology in the correction of juvenile myopia. *Med J West China* 2007;134:653.
92. Nie YM, Zhou SJ, Chen HY, et al. 21 cases of orthokeratology treatment in myopia. Presented at: The 12th National Congress of Ophthalmology in China. 2007. Zhengzhou, China.
93. Qi CX, Zhu CL, Dong LJ. The association between corneal curvature, central thickness and refractive errors in orthokeratology. *New Med* 2008;112:248–249.
94. Dai ZY, Zeng JW, Zhong XW, et al. Clinical observation of orthokeratology in myopia retardation. *J Optom* 2008;114:288–290.
95. Wang XY, Jia YH. Clinical research of orthokeratology in myopia correction. *Chin Pract Diagn Ther* 2008;113:540–541.
96. Xie PY, Wang ZX, Chi H. The long-term observation of the efficacy and safety of orthokeratology in the treatment of adolescent myopia. *Chin J Strabismus Amblyopia* 2008;111:145–152.
97. Nie YM, Zhou SJ, Liu B, et al. Orthokeratology in myopic amblyopia, case report. *J Optom* 2009;116:381–385.
98. Yuan YZ, Sun RX, Chai YX, et al. Short-term observation of orthokeratology in myopia correction in adolescent population. *Hebei Med* 2009;115:1613–1614.
99. Guo HL, Hong LH. Clinical observation of orthokeratology in myopia correction in adolescent population. *Chin J Mod Med* 2009;117:60–61.
100. Huang J, Chen YC. The clinical observation of the efficacy and safety of orthokeratology in the treatment of myopia. *Jiangsu Tech Inform* 2009;118:43–44.
101. Yang YD, Zhao H, Yang LD, et al. Confocal microscopy evaluation of corneal histology after orthokeratology. *J Clin Ophthalmol China* 2010;21:385–388.
102. Yang CH, Lu SJ, Gao L, et al. The analysis of orthokeratology patient population. *Chin J Ophthalmol Otolaryngol* 2010;22:221–223.
103. Wang YJ, Chen DY, Cheng W, et al. The clinical observaton of orthokeratology in myopia correction and the analysis of the complications. *Int J Ophthalmol* 2010;20:1582–1584.
104. Xia GX, Wei SH, Han EY, et al. The clinical observation of orhtokeratology treatment in different age groups. *Int J Ophthalmol* 2011;51:1298–1299.
105. Xia Q, Guo YR. The comparison of two different methods of orthokeratology fitting in myopia retardation. *J Pract Med Tech* 2011;50:746–747.
106. Zeng Y, Shi X, Huai M. The analysis of clinical efficacy of orthokeratology. *Xiangxi Med* 2011;49:448–449.
107. Mei F, Chen ZJ. The investigation of corneal epithelial damage associated with orthokeratology. *Shandong Ophthalmol Otolarygol* 2011;52:90–92.
108. Wang ZB, Feng M, Tu PP. Clinical observation of the efficacy of orthokeratology in myopia control. *Chin J Physicians* 2011;59:6476–6477.
109. Shi HJ, Jiang HY, Zhou F, et al. The change of central corneal curvature and refractive power after orthokeratology. Presented at: Conference of Ophthalmology of ZheJiang Provincem; 2011; Taizhou, China.
110. Jiang HY, Zhou F, Sun XN, et al. The effects of orthokeratology on corneal endothelium and central corneal thickness in juvenile myopia. Presented at: 2011 Conference of Ophthalmology of ZheJiang Province; 2011; Taizhou, China.

111. Zhu CM. The long-term effect of orthokeratology on corneal endothelium. *J Laser* 2011;58:79.
112. Xie XY, Lu YB, He BH, et al. The clinical observation of orthokeratology treatment in juvenile myopia. *Int J Opththalmology* 2011;55:1442–1443.
113. Tan WH. Clinical observation of 72 cases of orthokeratology in juvenile myopia. *Mod Med* 2011;46:88.
114. Zhao HM, Yu J, Sheng MJ, et al. Short-term observation of 72 cases of orthokeratology in juvenile myopia. *New Dev Ophthalmol* 2011;45: 239–240.
115. Jin YM, Zhang Y, Li H, et al. The effects of orthokeratology on corneal endothelium and corneal thickeness. *J Xiehe Med* 2011;47:155–158.
116. Han LY, Huang L, Zhu L. Lens adjustment in orthokeratology treatment. *Hainan Med* 2011;54:87–88.
117. Xia GX, Wei SH, Zhang QS. Orthokeratology in myopia correction of various refractive severity. *J Int Ophthalmol* 2012;26:577–578.
118. Song XK, Qu LL, Ding XP. The analysis of the clinical effects of orthokeratology in myopia control. *Chin Guide Ther* 2012;33:550–551.
119. Xing YC, Hu MS, Wang W, et al. Clinical observation of orthokeratology in the control of adolescent myopia. Presented at: The 11th Congress of Opthalmology of Xianxi; 2012; Yingtan, China.
120. Li RL, Mao PA, Xie Y, et al. Clinical observation of orthokeratology in the correction of adolescent myopia. *Chin J Pediatr Strabismus Amblyopia* 2012;25:31–34.
121. Yang L, Meng LJ, Yan X. The effect of patient age on the efficacy of orthokeratology. *Chin Mod Med* 2012;28:22–23.
122. Yang L, Huang HM, Yan X. The effect of orthokeratology in the control of adolescent myopia. *Chin Healthc Industry* 2012;31:115.
123. Liang L, Wen YC, Ke LJ, et al. The clinical observation of various methods in fitting orthokeratology. *Anhui Med* 2012;23:85–86.
124. Mao XJ, Zhou HX, Liu R, et al. The change of corneal biomechanical properties after orthokeratology. *Ophthalmol China* 2012;41:381–383.
125. Pan F. The indication and related complications of orthokeratology. Presented at: The 11th Congress of Ophthalmology of JiangXi Province; 2012; YingTan, China.
126. Wang QL. The clinical observation of orthokeratology in correcting adolescent myopia. *Xiangjiang Med* 2012;36:80–82.
127. Qu Z, Yang X, Wang HR, et al. The short-term effects of orthokeratology in central and peripheral corneal thickness. *Ophthalmol China* 2012;40: 376–380.
128. Xie PY. Revisiting orthokeratology. *Ophthalmol China* 2012;37:361–365.
129. Guo X, Yang LN, Xie PY. The long-term effectiveness of orthokeratology in myopia correction. *Ophthalmol China* 2012;39:371–374.
130. Chen JZ, Chen L, Li YY, et al. 423 Cases of orthokeratology treatment. *J Int Ophthalmol* 2012;24:130–132.
131. Chen ZJ, Zhang Y, Chen YX, et al. The efficacy of orthokeratology in high myopia. *Jiangsu Med* 2012;38:3013–3015.
132. Chen YQ, Luo YF, Luo C. The clinical observation of orthokeratology and the management of complications. *J Nurs* 2012;27:38–39.
133. Huang XZ, Zhang ZS, Zhao ZQ. The efficacy and safety of orthokeratology in refractive correction. *J Int Ophthalmol* 2012;29:1501–1503.
134. Zhou XJ. 87 cases of orthokeratology treatment. *Tele-education Chin Mod Med* 2013;100:59–60.
135. Zhou M, Sun JN, Ma J, et al. The effectiveness of orthokeratology in myopia correction and its compliance in adolescent population. *Chongqing Med* 2013;104:2540–2542.
136. Xia J, Zhang XM, Yang M, et al. Possible causes of decentration in overnight orthokeratology. *Chin Mod Ther* 2013;102:8–11.
137. Sun YQ. The effectiveness and safety of orthokeratology wear in different age groups. *J Pract Med* 2013;107:1972–1974.
138. Xu H, Bai NY, Zhu FL, et al. Short-term evaluation of orthokeratology in correcting juvenile myopia. Presented at: The 4th Southwestern Congress of Ophthalmology; 2013; GuiYang, China.
139. Zhu FL. The efficacy of orthokeratology in myopia control. Presented at: The 4th Southwestern Congress of Ophthalmology; 2013; GuiYang, China.
140. Li Y, Zhao MY, Yan L. Clinical observation of orthokeratology in myopia retardation. *J Clin Med* 2013;67:552–554.
141. Yang YY, Zheng L, Wang CL. The effects of orthokeratology in corneal curvature, thickness, and endothelium. *Chin Mod Physician* 2013; 99:159–160.
142. Wang J, Che XH, Gu YX. The efficacy of overnight orthokeratology in the treatment of myopic anisometropia. *J Int Ophthalmol* 2013:139–141.
143. Wang XB. The effect of daytime wear of orthokeratology. *Ophthalmol China* 2013;61:422.
144. Wang YW, Ma R, Yuan JS, et al. The short-term evaluation of digitalized orthokeratoloty in the correction of juvenile myopia. *Mod Pract Med* 2013; 96:218–220.
145. Wang X. The effect of orthokeratology in corneal curvature. Presented at: The 4th Southwestern Congress of Ophthalmology; 2013; GuiYang, China.
146. Xie XY, He BH, Wei LJ. The analysis of factors influencing the efficacy of orthokeratology. *J Int Ophthalmol* 2013;93:199–200.
147. Zhao Q. The clinical analysis of orthokeratology in myopia control. *Chin Guide Ther* 2013;62:317–318.
148. Zheng XM. The effectiveness and safety of orthokeratology in myopia correction. *J Communicty Med* 2013;101:49–50.
149. Wei LJ, Xie XY, He BH, et al. The clinical observation of the safety of orthokeratologyand its complications. *J Clin Ophthalmol* 2013;63: 461–463.
150. Yu Q. Two year observation of the clinical efficacy and safety of orthokeratology. Presented at: 2014 Congress of Opthalmology of ZheJiang Province; 2014; Wenzhou, China.
151. He YC. The observation of the effect of overnight orthokeratology in tear function. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
152. He BH, Xie XY, Wei LJ, et al. The role of sodium hyaluronate in orthokeratology treatment. *Guangxi Med* 2014;85:1144–1145.
153. Liu B, Ru HX, Wang H, et al. The analysis of topographical parameters in guiding orthokeratology in juvenile myopia. *Chin J Strabismus Pediatr Ophthalmol* 2014;81:1–4.
154. Lu TB, Wang LY, Zhang J. The observation of the short-term efficacy of toric design orthokeratology in correcting moderate astigmatism. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
155. Wu Q, Lu MZ. The efficacy of specially designed orthokeratology. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
156. Sun L, Bao JL, Zhou BB, et al. The efficacy of orthokeratology in the treatment of school myopia. *Pract Clin Med* 2014;75:69–70.
157. Meng N. The efficacy of long-term wear of orthokeratology. *Chin Mod Appl Ther* 2014;87:52–53.
158. Zhang LJ, Li Y, Zhao MY, et al. The indications of orthokeratology in juvenile myopia and its maintenance. *Chin J Strabismus Pediatr Ophthalmol* 2014;78:36–37.
159. Zhang SX. Short-term observation of the efficacy of toric design orthokeratology in juvenile myopia combined with moderate to high astigmatism. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
160. Zhu FL, Bai NY, Xu H, et al. The clinical research of orthokeratology in the control of juvenile myopia. *Chin J Strabismus Pediatr Ophthalmol* 2014;69:43–44.
161. Li H, Liu JL. Summary of the Effectiveness of 998 Cases of Orthokeratology treatment. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
162. Li J. The efficacy of orthokeratology in myopia control. *Chin J Clin Physician* 2014;71:353–355.
163. Li R. The effectivenss and safety of 18 cases of orthokeratology treatment. *Chin Pract Med* 2014;82:68–69.
164. Du XL. The change of objective visual quality after orthokeratology. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
165. Yang Y, Wu ZZ. The effect of orthokeratology in the unaided vision and refractive changes of juvenile high myoia. *Pract Clin Med* 2014;90:27–30.
166. Yang XY, Zhang Y, Zhan SX. The effect of IOP on the efficacy of orthokeratology. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
167. Yang LX. Follow-up studies on 62 cases of orthokeratology. *J Shanxi Med* 2014;70:782–783.
168. Liang SS, Liang M, Lu YL, et al. The short-term efficacy of Meidaiwei orthokeratology. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
169. Mei Y. The analysis of the efficacy of toric design orthokeratology in the correction of moderate astigmatism. Presented at: 2014 Conference of Opthalmology of Zhejiang Province; 2014; Wenzhou, China.

170. Mao J, Wang L. The corneal morphylogical changes of low to moderate myopia after orthokeratology treatment. *Chin J Strabismus Pediatr Ophthalmol* 2014;83:7–8.
171. Wang XB, Qu N, Ma FR, et al. Refraction after orthokeratology. *Ophthalmol China* 2014;80:214.
172. Wang QL, Dong N, Sun CG, et al. The clinical observation of orthokeratology in myopia control. *Xinjiang Med* 2014;79:86–87.
173. Wang YM, Li ZZ, Xu F, et al. The effect of orthokeratology on axial length, IOP, and corneal topography. *Med West China* 2014;86:1125–1127.
174. Fu AC, LV Y, Li XH, et al. Factors influencing the efficacy of Myopia control with rthokeratology. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
175. Dong N, Wang QL, Sun CG. Sunchunge the clinical observation of orthokeratology in myopia control. *Xijiang Med* 2014;72:58–59.
176. Xuan X, Song D. The clinical observation of orthokeratology in myopia correction. *Clin J Med Officer* 2014;91:266–267.
177. Qiu XR, Shi LX. The clinical observation of orthokeratology in myopia control. *Chin Plast Med* 2014;89:8–9.
178. Guo YZ, Wang H, He SX, et al. The change of astigmatism after orthokeratology. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
179. Zhong YY, Zhou XT. The mechanism of orthokeratology in myopia control. *Chin J Ophthalmol Otolaryngol* 2014;68:121–123.
180. Yan BX. The effect of 3 weeks of discontinuation of orthokeratology in corneal front surface curvature and corneal astigmatism. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
181. Wei LJ, Xie XY, He BH, et al. The efficacy and safety of long-term wear of orthokeratology in juvenile population. *J Int Ophthalmol* 2014;66:125–127.
182. Wei W, Xue YL, Zhang CN. Clinical application of orthokeratology in high astigmatism. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
183. Ma W, Yang B. The clinical observation of orthokeratology among juveniles of various age. Presented at: The 3rd International Congress of Orthokeratology; 2014; Shanghai, China.
184. Yan T, Luan GG, Chen JJ, et al. The effect of orthokeratology on refractive system and IOP of juvenile myopia. *Shandong Ophthalmol Otolaryngol* 2015;131:69–71.
185. Li J, Dong P, Wang CX, et al. The effect of overnight orthokeratology on corneal morphology and tear film. *J Int Ophthalmol* 2015;129:205–207.
186. Li B, Niu Y, Li C, et al. The comparison of the effectiveness of orthokeratology versus spectacle correction in indicental myopia. *New Dev Ophthalmol* 2015;125:78–80.
187. Wang YF, Xie SG, Luo J, et al. The effect of long-term wear of orthokeratology in tear film stability. *J Zhongnan Med Sci* 2015;127:63–66.
188. Gao WS, Chen ZL. The mechanism of orthokeratology in myopia correction. *Chin J Ther Sci* 2015;128:60–62.
189. Xie PY, Chi H, Zhang Y, et al. Effects of wearing long-term Ortho-K contact lens on corneal thickness and corneal endothelium. *Zhonghua Yan Ke Za Zhi* 2007;43:680–683.
190. Mao XJ, Huang CC, Chen L, et al. A study on the effect of the corneal biomechanical properties undergoing overnight orthokeratology. *Zhonghua Yan Ke Za Zhi* 2010;46:209–213.
191. Lin MC, Graham AD, Fusaro RE, et al. Impact of rigid gas-permeable contact lens extended wear on corneal epithelial barrier function. *Invest Ophthalmol Vis Sci* 2002;43:1019–1024.
192. China Food and Drug Administration. *Orthokeratology Lens Fitting Operations Supervision Management Regulations* 2001;326. Available at: http://baike.baidu.com/view/2531030.htm#1. Accessed November 10, 2015.
193. Luce DA. Determining in vivo biomechanical properties of the cornea with an ocular response analyzer. *J Cataract Refractive Surg* 2005;31: 156–162.